

*On the Observations of Stars made in some British
Stone Circles.—Preliminary Note.*

By Sir NORMAN LOCKYER, K.C.B., F.R.S., LL.D., Sc.D.

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In continuation of my work in Egypt in 1891, and Mr. Penrose's in Greece in 1892, I have recently endeavoured to see whether there are any traces in Britain of the star observations which I found connected with the worship of the sun at certain times of the year.

A star rising about an hour before the sun was watched in order to determine the time at which it was necessary to begin the preparations of the sacrifice which took place at the sun's rising. I stated that Spica was the star the heliacal rising of which heralded the sun at Thebes on May-day in the temple of Min, 3200 B.C. Sirius was associated with the Summer Solstice at about the same time. The equinoxes were provided for in the same way in Lower Egypt, but they do not concern us now.

Mr. Penrose found the May-day worship continued at Athens on foundations built in 1495 B.C. and 2020 B.C., on which the Hecatompodon and older Erechtheum respectively were subsequently built, the warning star being now no longer Spica, but the cluster of the Pleiades.

It is generally known that Stonehenge is associated with the Solstitial Year. I have recently suggested that it was originally connected with the May Year, but, so far as I know, no inquiry has yet been made to connect star observations with it or with any other of the British Circles.

I have recently obtained clear evidence that some circles in different parts of Britain were related to the May Year, a vegetation year, which we know was general over the whole of Europe in early times, and which still determines the quarter-days in Scotland.

If the Egyptian and Greek practice were continued here, we should expect to find some indications of the star observations utilized at the temple of Min and at the Hecatompodon for the beginning of the May-year.

Following the clue given me in the case of the Egyptian temples, such as Luxor, by successive small changes of the axis necessitated by the change in a star's place due to precession, I looked out for this peculiarity in an examination of many maps and plans of circles.

I have already come across two examples in which the sight line has been

changed in the Egyptian manner. The first is the three circles of the Hurlers, near Liskeard, a plan of which is given in "Prehistoric Stone Monuments of the British Isles: Cornwall," by H. C. Lukis, published by the Society of Antiquaries, who were so good as to furnish me with a copy, and also some *unfolded* plans on which sight lines can be accurately drawn and their azimuths determined. I am anxious to express my obligations to the Council and officers of the Society for the help thus afforded me.

The second is at Stanton Drew, in Somerset, consisting of three circles, two avenues, and at least one outstanding stone. These were most carefully surveyed by Mr. C. E. Dymond some years ago, and he was good enough to send me a copy of his plans and levelling sections.

To investigate these cases as completely as possible without local observations in the first instance, I begged Colonel Johnston, R.E., C.B., the Director-General of the Ordnance Survey, to send me the 25-inch maps of the sites, giving the exact azimuth of the side lines. This he obligingly did, and I have to express my great indebtedness to him.

Of the various sight-lines found, those to which I wish to call attention in the first instance, and which led me to the others, are

Hurlers.		Stanton Drew.	
Lat. 50° 31' N.	Az.	Lat. 51° 10' N.	Az.
S. circle to central circle	N. 12° E.	Great circle to Quoit	N. 17° E.
Central to N. circle	N. 15 E.	S.W. circle to Quoit	N. 20 E.
N. circle to tumulus ...	N. 19 E.		

For the purposes of a preliminary inquiry in anticipation of the necessary local observations with a theodolite, for which I am making arrangements, assuming hills half a degree high, which roughly compensate the refraction correction so that we may use sea-horizon values, we have the following declinations approximately:—

The Hurlers.	Lat. 50° 31'.	Stanton Drew.	Lat. 51° 10'.
	Dec. N. 38½°		Dec. N. 37°
"	38	"	36½
"	37		

I have prepared a diagram showing the declination of the three brightest stars in the northern heavens, having approximately the declinations in question, for the period 0 to 2500 B.C. The calculations for 0 to 2000 B.C. are taken from the tables published by Dr. Danekwortt, in the 'Proceedings of

the Astronomische Gesellschaft,' and have been completed from 2000 to 2500 B.C. by Dr. Lockyer.

Vega is ruled out as its declination is too high. The remaining stars Capella and Arcturus may have been observed so far as the declinations go. For time limits we have:—

Dec. N.	Capella.	Arcturus.
$38\frac{1}{2}^{\circ}$	500 B.C.	1550 B.C.
36	1050 „	1150 „

The interesting fact must be pointed out that about 1000 B.C. the declination of the two stars was very nearly the same.

Now there is no question as to which of these two remaining stars we have to deal with, for I find by the use of a precessional globe, that for about 1400 B.C. and 800 B.C. the warning stars were as follows for the critical times of the year, *i.e.*, May, August, November, February.

1400 B.C.		800 B.C.	
	Az.		Az.
May.. .. .	Pleiades rising	Pleiades rising	
August ...	Arcturus rising	Sirius rising	
November	Capella setting	Betelgeuse setting	
February...	Capella rising	Capella rising	N. 21° E.
	Dec. 34 N.		Dec. 37 N.

It is quite clear then that we have to deal with Arcturus, and this being so, the approximate dates of the use of the three circles at the Hurlers can be derived. They are:—

	B.C.
Southern circle aligning Arcturus over centre of central circle ...	1600
Central „ „ „ N. circle	1500
Northern „ „ „ tumulus	1300

I have already pointed out that Mr. Penrose found the warning star for May morning at the date of foundation of the Hecatompodon, 1495 B.C., to be the group of the Pleiades. As the foundations of the Hecatompodon were only built some few years after the stones of the central circle of the Hurlers were used, we ought to find traces of the observations of the same May morning stars. We do: there is a stone with amplitude E. 11° N., which, when aligned from the S circle, would have pointed out the rising place of

the Pleiades about 1600 B.C., the date we have already found from the observations of Arcturus. I regard this as an important confirmation of the time of the use of the temple, all the more as the high situation of the circles, not generally dominated by higher levels for some miles, renders it probable that large corrections for hills will not be required to be made.

The place of sunrise in November is indicated by sight-lines from all three circles (Az. S. $67^{\circ}9$ E.).

There are alignments in connection with the N. circle which suggest the introduction of the solstitial year, but these and some others may wait till local observations have been made before more is said about them.

With regard to Stanton Drew it is clear that we are there also dealing with Arcturus. Mr. Dymond's levels give an idea of the height of the hills, so with the Ordnance map azimuths, read to 1° , the provisional dates of the use of the Great and S.W. Circles are as under:—

	B.C.
Great Circle	1075
S.W. Circle	1260
